Boston, MA
Workshop Report

Introduction

A Port Risk Assessment Workshop was conducted for the Port of Boston 19-21 June, 2000. This workshop report provides the following information:

- Brief description of the process used for the assessment;
- List of participants;
- Numerical results from the Analytic Hierarchy Process (AHP) [1]; and
- Summary of risks and mitigations discussion.

Strategies for reducing unmitigated risks will be the subject of a separate report.

Assessment Process

The risk assessment process is a structured approach to obtaining expert judgments on the level of waterway risk. The process also addresses the relative merit of specific types of Vessel Traffic Management (VTM) improvements for reducing risk in the port. Based on the Analytic Hierarchy Process (AHP), the port risk assessment process uses a select group of experts/stakeholders in each port to evaluate waterway risk factors and the effectiveness of various VTM improvements. The process requires the participation of local Coast Guard officials before and throughout the workshops. Thus the process is a joint effort involving waterway user experts, stakeholders, and the agencies/entities responsible for implementing selected risk mitigation measures.

This methodology employs a generic model of port risk that was conceptually developed by a National Dialog Group on Port Risk and then translated into computer algorithms by the Volpe National Transportation Systems Center. In that model, risk is defined as the sum of the probability of a casualty and its consequences. Consequently, the model includes variables associated with both the causes and the effects of vessel casualties. Because the risk factors in the model do NOT contribute equally to overall port risk, the first session of each workshop is devoted to obtaining expert opinion about how to weight the relative contribution of each variable to overall port risk. The experts then are asked to establish scales to measure each variable. Once the parameters have been established for each risk-inducing factor, each port's risk is estimated by putting into the computer risk model specific values for that port for each variable. The computer model allows comparison of relative risk and the potential efficacy of various VTM improvements between different ports.

[1] Developed by Dr. Thomas L. Saaty, et al, to structure complex decision making, to provide scaled measurements, and to synthesize many factors having different dimensions.

Participants

The following is a list of stakeholders/experts that participated in the process:

Participant	Organization	Phone	Email
Peter Caten	Mass Boating & Yacht Clubs	(978) 927-3565	k10@mediaone.net
Tom Donlan	Spirit of Boston	(617) 748-1499	tdonlan@spiritcruises.com
LT Brian Downey	USCG Marine Safety Office Boston	(617) 223-3006	bdowney@msoboston.uscg.mil
David Galman	Boston Towing & Transportation	(617) 567-9100	N/A
Debbie Hadden	Massport Maritime	(617) 946-4435	dhadden@massport.com
Pamela Korejwa	USCG Auxiliary	(781) 878-0725	pamk@massed.net
Joseph McKechnie	Peabody & Lane, Corp.	(617) 241-3712	pealane@gateway.net
LTJG Tiffany Olson	USCGC Grand Isle	(978) 281-8453	Tolson14@cs.com
Ross Pope	Moran Shipping	(617) 428-6034	bos@moranshipping.com
BM1 Roger Rice	USCG Station Gloucester	(978) 281-8453	rrice@stagloucester.uscg.mil
LTJG Matt Rudick	USCG First District (oan)	(617) 223-8385	mrudick@d1.uscg.mil
LTJG Dave Sherry	USCG Marine Safety Office Boston	(617) 223-3008	dsherry@msoboston.uscg.mil
Phillip Terenzi	Boston Police, Harbor Unit	(617) 343-4721	phillipterenzi@email.com
BM2 Daniel Wenger	USCG Station Point Allerton	(781) 925-0166	dwenger@staptallerton.uscg.mil
Jeanne White	Mass Boating & Yacht Clubs	(617) 327-8683	mbyca@concentric.net
CAPT Joel Whitehead	USCG Marine Safety Office Boston	(617) 223-3025	jrwhitehead@msoboston.uscg.mil
Arthur Whittemore	Boston Pilots	(617) 569-4500	bospilot@aol.com
LTJG Abby Wilcox	USCG Marine Safety Office Boston	(617) 223-3000	Awilcox@msoboston.uscg.mil

Facilitation Team Members	Organization	Phone	Email
Dave Murk	USCG Commandant (G-MWV)	(202) 267-1539	dmurk@comdt.uscg.mil
Doug Perkins	Potomac Management Group, Inc.	(703) 836-1037	dperkins@potomacmgmt.com
Fred Edwards	Soza & Company, Ltd.	(703) 560-9477	fredwards@soza.com
Kris Higman	Potomac Management Group, Inc.	(757) 838-5296	khigman@hotmail.com

Numerical Results

Book 1 – Risk Categories *(Generic Weights Sum to 100)*

Fleet Composition	Traffic Conditions	Navigational Conditions	Waterway Configuration	Short-term Consequences	Long-term Consequences
19.3	17.9	23.9	14.5	13.7	10.7

Analysis:

Book 1 begins the process of weighting the national port risk model. The participant teams contribute their knowledge, using the AHP process, to provide weights to the six major risk categories. The contribution to the national model by the Port of Boston participants is as listed above. These participants felt that Navigational Conditions was the largest driver of risk. Long-term consequences was a significantly lower influence.

Book 2 - Risk Factors *(Generic Weights)*

Fleet Composition	Traffic Conditions	Navigational Conditions	Waterway Configuration	Short-term Consequences	Long-term Consequences
19.3	17.9	23.9	14.5	13.7	10.7

% High Risk Deep Draft	Volume Deep Draft	Wind Conditions	Visibility Obstructions	Volume of Passengers	Economic Impacts
13.6	3.0	4.4	5.2	5.5	3.2
% High Risk Shallow Draft	Volume Shallow Draft	Visibility Conditions	Passing Arrangements	Volume of Petroleum	Environmental Impacts
5.7	2.2	13.4	3.2	2.4	2.1
	Vol. Fishing & Pleasure Craft	Current, Rivers, & Tides	Channel & Bottom	Volume of Chemicals	Health & Safety Impacts
	9.0	3.0	3.6	5.8	5.4
	Traffic Density	Ice Conditions	Waterway Complexity		
	3.7	3.1	2.7		

Analysis:

Book 2 further refines the weighting for the national port risk model. The participants examined the importance to port safety for each of the 20 risk factors and provided the above results to the national model. They determined that the following factors contributed the most to overall risk under each of the six major categories:

- Fleet Composition: High-Risk Deep Draft Vessels contribute the greatest amount of risk; High-Risk Shallow Draft Vessels contribute the fifth highest amount of risk.
- Traffic Conditions: Volume of Fishing and Pleasure Craft contributes the third highest amount of risk.
- Navigational Conditions: Visibility Conditions contribute the second highest amount of risk.
- Waterway Configuration: Visibility Obstructions is the most important contributor to risk in this category.
- Short-term Consequences: The Volume of Chemicals contributes the fourth highest amount of risk.
- Long-term Consequences: Health and Safety Impacts are the most important contributor to risk in this category.

Book 3 Factor Scales - Condition List *(Generic)*

	Scale Value
Wind Conditions	
a. Severe winds < 2 days / month	1.0
b. Severe winds occur in brief periods	2.0
c. Severe winds are frequent & anticipated	4.5
d. Severe winds occur without warning	9.0
Visibility Conditions	
a. Poor visibility < 2 days/month	1.0
b. Poor visibility occurs in brief periods	1.9
c. Poor visibility is frequent & anticipated	4.6
d. Poor visibility occurs without warning	9.0
Current, Tide or River Conditions	
a. Tides & currents are negligible	1.0
b. Currents run parallel to the channel	2.0
c. Transits are timed closely with tide	4.7
d. Currents cross channel/turns difficult	9.0
Ice Conditions	
a. Ice never forms	1.0
b. Some ice forms-icebreaking is rare	1.6
c. Icebreakers keep channel open	4.9
d. Vessels need icebreaker escorts	9.0
Visibility Obstructions	
a. No blind turns or intersections	1.0
b. Good geographic visibility-intersections	1.5
c. Visibility obscured, good communications	4.3
d. Distances & communications limited	9.0

Passing Arrangements

a. Meetings & overtakings are easy	1.0
b. Passing arrangements needed-ample room	1.6
c. Meetings & overtakings in specific areas	5.3
d. Movements restricted to one-way traffic	9.0

Channel and Bottom

a. Deep water or no channel necessary	1.0
b. Soft bottom, no obstructions	1.5
c. Mud, sand and rock outside channel	4.6
d. Hard or rocky bottom at channel edges	9.0

Waterway Complexity

a. Straight run with NO crossing traffic	1.0
b. Multiple turns > 15 degrees-NO crossing	2.2
c. Converging - NO crossing traffic	5.0
d. Converging WITH crossing traffic	9.0

Passenger Volume

a. Industrial, little recreational boating	1.0
b. Recreational boating and fishing	3.3
c. Cruise & excursion vessels-ferries	5.6
d. Extensive network of ferries, excursions	9.0

Petroleum Volume

a. Little or no petroleum cargoes	1.0
b. Petroleum for local heating & use	2.3
c. Petroleum for transshipment inland	4.9
d. High volume petroleum & LNG/LPG	9.0

Chemical Volume

a. Little or no hazardous chemicals	1.0
b. Some hazardous chemical cargo	1.9
c. Hazardous chemicals arrive daily	5.0
d. High volume of hazardous chemicals	9.0

Economic Impacts

a. Vulnerable population is small	1.0
b. Vulnerable population is large	3.9
c. Vulnerable, dependent & small	5.6
d. Vulnerable, dependent & large	9.0

Environmental Impacts

a. Minimal environmental sensitivity	1.0
b. Sensitive, wetlands, VULNERABLE	2.9
c. Sensitive, wetlands, ENDANGERED	5.9
d. ENDANGERED species, fisheries	9.0

Safety and Health Impacts

a. Small population around port	1.0
b. Medium - large population around port	2.6
c. Large population, bridges	5.8
d. Large DEPENDENT population	9.0

Analysis:

The purpose of Book 3 is for the participants to calibrate a risk assessment scale for each risk factor. For each risk factor there is a low (Port Heaven) and a high (Port Hell) severity limit, which are assigned values of 1.0 and 9.0 respectively. The participants determined numerical values for two intermediate qualitative descriptions between those two extreme limits. On average, participants from this port evaluated the difference in risk between the lower limit (Port Heaven) and the first intermediate scale point as being equal to 1.2; the difference in risk between the first and second intermediate scale points was equal to 2.8; and the difference in risk between the second intermediate scale point and the upper risk limit (Port Hell) was 4.0.

Book 4 - Risk Factor Ratings *(Port of Boston)*

Fleet Composition	Traffic Conditions	Navigational Conditions	Waterway Configuration	Short-term Consequences	Long-term Consequences
% High Risk Deep Draft 3.3	Volume Deep Draft 2.6	Wind Conditions 2.0	Visibility Obstructions 2.2	Volume of Passengers 8.6	Economic Impacts 6.9
% High Risk Shallow Draft 5.1	Volume Shallow Draft 5.4	Visibility Conditions 2.6	Passing Arrangements 3.8	Volume of Petroleum 8.5	Environmental Impacts 5.0
	Vol. Fishing & Pleasure Craft 7.1	Current, Rivers, & Tides 3.0	Channel & Bottom 6.8	Volume of Chemicals 1.9	Health & Safety Impacts 5.8
	Traffic Density 6.4	Ice Conditions 2.5	Waterway Complexity 6.8		

Analysis:

This is the point in the workshop when the process begins to address local port risks. The participants use the scales developed in Book 3 to assess the absolute level of risk in their port for each of the 20 risk factors. The values shown in the preceding table do NOT add up to 100. Based on the input from the participants, the following are the top risks to port safety in Port of Boston (in order of importance):

1. Volume of Passengers
2. Volume of Petroleum
3. Volume of Fishing and Pleasure Craft
4. Economic Impacts
5. Channel and Bottom
6. Waterway Complexity

Book 5 - VTM Tools *(Port of Boston)*

Fleet Composition	Traffic Conditions	Navigation Conditions	Waterway Configuration	Short-term Consequences	Long-term Consequences

% High Risk Deep Draft		Volume Deep Draft		Wind Conditions		Visibility Obstructions		Volume of Passengers		Economic Impacts	
13	-0.1	**17**	-0.4	**19**	-0.5	**20**	-0.8	**1**	2.6	**2**	2.3
RA		RA		RA		RA		RA	ALERT	VTS	ALERT
% High Risk Shallow Draft		**Volume Shallow Draft**		**Visibility Conditions**		**Passing Arrangements**		**Volume of Petroleum**		**Environmental Impacts**	
10	0.7	**7**	1.3	**15**	-0.2	**11**	0.4	**4**	2.1	**12**	0.4
RA		RA		RA		RA		RA		RA	
		Vol. Fishing & Pleasure Craft		**Currents, Tides, Rivers**		**Channel & Bottom**		**Volume of Chemicals**		**Health & Safety Impacts**	
		3	2.2	**14**	-0.1	**8**	1.2	**18**	-0.5	**8**	1.2
		IER		RA		RA		RA		RA	
		Traffic Density		**Ice Conditions**		**Waterway Complexity**					
		6	1.4	**16**	-0.3	**5**	1.4				
		RA		RA		RA					

Legend:

See the **KEY** (below). Rank is the position of the Risk Gap for a particular factor relative to the Risk Gap for the other factors as determined by the participants. Risk Gap is the variance between the existing level of risk for each factor determined in Book 4 and the average acceptable risk level as determined by each participant team. Negative numbers imply that the risk level could INCREASE and still be acceptable. The teams were instructed as follows: *If the acceptable risk level is higher or equal to the existing risk level for a particular factor, circle RA (Risk Acceptable) at the end of that line. Otherwise, circle the VTM tool that you feel would MOST APPROPRIATELY reduce the unmitigated risk to an acceptable level*.

The tool listed is the one determined by the majority of participant teams as the best to narrow the Risk Gap. An ALERT is given if no mathematical consensus is reached for the tool suggested. Below are the tool acronyms and tool definitions.

KEY					
Risk Factor	RA	Risk Acceptable			
	IER	Improve Existing Rules	AIS	Automatic Identification System	
	INI	Improve Navigation Information	EAIS	Enhanced AIS	
Rank Risk Gap	IAN	Improve Aids to Navigation	VTIS	Vessel Traffic Information System	
Tool ALERT	IEA	Improve Electronic ATON	VTS	Vessel Traffic System	

Analysis:

The results shown are consistent with the discussion that occurred about risks in the Port of Boston area. For 17 out of the 18 risk factors for which there was good consensus, the participants judged the risk to be at an acceptable level already due to existing mitigation strategies.

No consensus alerts occurred for the following reasons:

- Volume of Passengers – Votes were split between RA (3), IER (1), AIS (1), EAIS (1), VTIS (2)
- Economic Impacts – Votes were split between RA (2), IER (2), AIS (1), VTIS (3)

Summary of Risks

Scope of the port area under consideration: The participants addressed the geographic bounds of the port area to be discussed.

- Port Area: The port area is bounded by the BG entrance buoy (five NM offshore) inward, and all the tidewater lying within a line from the southern extremity of Deer island to Point Allerton, about 4 miles to the southeastward including:
  1. Charles River up to Mass Avenue Bridge;
  2. Mystic River to Broadway Bridge;
  3. Chelsea River to turning basis just north of global docks;
  4. Winthrop (recreational boating);
  5. Fore River to Quincy Bay; and
  6. Town River and Back River
- Other Additional Risk Areas: Numerous dangers lie in the approaches to the harbor. The northeastern approach is obstructed by islands and shoals which extend 4 miles from the entrance; between them are the dredged channels which lead into the harbor. In the southeastern approach, broken ground extends as much as 3 miles from shore.

RISK FACTORS	RISKS	MITIGATIONS
Fleet Composition		
% High Risk Deep Draft Cargo & Passenger Vessels	• Less than 10% are high risk based on Port State Control Category I and Category II foreign flag vessels. • Crew composition is a concern on LNG ships; Algerian crews are a security issue (terrorism). • 99.5% foreign flag crew quality is satisfactory. • 50 to 60 arrivals per year are former Soviet bloc ships.	No mitigation factors were discussed.
% High Risk Shallow Draft Cargo & Passenger Vessels	• Tugs and barges: 1. Variety of quality of equipment on board tugs including basic safety. 25% of tugs fall into high-risk category. 2. Tugs and barges are mostly professional. Boston tugs do not present a risk. 3. Out of area tugs less so, but are not a source of casualties due to lack of local knowledge. • Recreational boats: 1. Lots of educational courses available, but few are taken. 2. Expertise is lacking in safe boating, but when the course is taken, operators admit learning things. 3. Quality of recreational boats improving over the years; fiberglass replacing wood. 4. Small sailboats crossing the channel ignore traffic, including large commercial vessels. • Commuter/ferry boats: 1. High speed (up to 35 knots) including in the fog and around regattas; 2. Swamp smaller sailing craft; 3. Boston is now a 'backwater" for high-speed commuters; this is just the beginning. • Fishing boats: 1. Quality is improving, but more slowly. 2. Only problems are with people fishing in the middle of the channel.	**Existing mitigations:** • Personal watercraft is not permitted inshore of Castle Island. • The high maneuverability, propulsion visibility is a risk mitigator. **New mitigation:** • No new mitigation factors were discussed.

Continued Next Page

RISK FACTORS	RISKS	MITIGATIONS
Traffic Conditions		
Volume of Deep Draft Vessels	**Today:** • 800 ships per year in deep draft category • Volume of deep draft traffic would have to increase significantly before traffic density would be a problem. **Trends:** • Slow upward trend in cruise ships (seasonal April through October). • Significant (1 per month to at least 1 per week) increase in LNG carriers.	**Existing Mitigations**: • LNG carriers require moving safety zone around each tanker. No meeting traffic, no traffic a mile ahead or behind the tanker. • LNG arrivals are announced. No problems of interference with their movements to date. Other commercial vessels respect the moving safety zone. **New mitigation:** • No new mitigation factors were discussed.
Volume of Shallow Draft Vessels	**Today:** • More tour and commuter boats want to use certain docks although those particular dock spaces are not available; Rowes Wharf and Long Wharf were specifically identified. **Trend:** • Number of commuter ferries is increasing. • Number of commercial fishing vessels is decreasing sharply. • Number of seasonal harbor cruise boats is increasing. • Number of seasonal whale watch boats is increasing. • Tugs are remaining constant. • Fore River barge traffic • Town River barge traffic	No mitigation factors were discussed.

Continued Next Page

RISK FACTORS	RISKS	MITIGATIONS
Traffic Conditions (Continued)		
Volume of Fishing & Pleasure Craft	Marinas and yacht clubs are distributed throughout the Port. Preponderance of watercraft come from water storage in marinas and clubs, not trailer launching. **Today:** • Hundreds during the week; number is in the thousands on a good weekend in the summer. • High seasonal traffic in recreational boats • High seasonal traffic in sailboats • Marinas in Winthrop, Charlestown, Chelsea, Jeffery's Cove, Orient Heights • 50 to 60 yacht clubs as well as marinas throughout the harbor • Risk on a weekend afternoon is out of control. • Commercial traffic is 24 X 7, including weekends. **Trend:** • Continued dramatic increase in number of pleasure craft • Larger pleasure craft	**Existing mitigations:** • Jet ski regulations defining where they can and cannot operate • Speed regulations • Regatta permits (but still cross the main ship channels) **New mitigations:** • Change regatta permit course selection process – any rule 9 violations will be automatic denial of future regattas. • Educate boating public to stay out of channels. • Enforcement of boating laws. • Increase size of marine police force to conduct more enforcement. • Enforce laws at known congestion areas. • Limit times of recreational boat use in choke-points. • Alter steaming schedules of commercial traffic to avoid heaviest recreational traffic.
Traffic Density	• Congestion 1. Off Long Wharf and Rowes Wharf 2. Anchorage 2 off Deer Island • Barge traffic in vicinity of Spectacle Island (dumping ground for the "Big Dig").	No mitigation factors were discussed.
Navigational Conditions		
Wind Conditions	• Winter high winds affect safe navigation once a week. • 85 car carriers last year, 100 next year. Winds do not interrupt schedules yet. • Recreational boating – virtually none during the winter months; therefore, not an issue. • Summer: sudden squalls and thunder storms are worst problem for small boats; twice a month in the summer. Squalls are not predicted.	**Existing mitigation:** • Rely on more tugs. If real bad, then stop navigating. **New mitigation:** • No new mitigation factors were discussed.

Continued Next Page

RISK FACTORS	RISKS	MITIGATIONS
Navigational Conditions (Continued)		
Visibility Conditions	• 24 days of fog a year – ¼ mile or less visibility. With a higher propensity in the spring and early summer. • Fog sometimes occurs as a fog period, not a fog day. • August: 4 to 5 hours in the morning; fog up to 5 days a week, and it affects recreational boaters. • Difficult to see/detect small boats in the fog. They go DIW. They do not have radar flectors. Duckling syndrome – follow big guys in thinking they know where they are going, then try to scoot around the ships in a restricted channel.	No mitigation factors were discussed.
Currents, Tides and Rivers	• Current at Hull Gut at 6 to 7 knots in severe conditions, 4 to 5 routinely. • Sheep Island in Fore River mouth has 4 to 5 knot current. • Current at entrance to Charles River when sluices are opened in the spring at Charles River Dam; not a cross channel problem; follows the shoreline.	**Existing mitigation:** • Locks open in advance of hurricanes to lower basin depth.
Ice	• Back River and Fore River ice backs up. CG 65-footer cuts to keep it moving. Even in a normal winter 8 to 10 inches. Packs up against the docks. • Ice damages aids to navigation and moves them off station. • Ice damages docks and results in floating debris. • Ice is not a problem in Chelsea or Mystic Rivers.	**Existing mitigation:** • Rely on CG assistance

Continued Next Page

RISK FACTORS	RISKS	MITIGATIONS
Waterway Configuration		
Visibility Obstructions	• Entrance to Mystic River at Tobin Bridge (Car carrier facility on south side of Mystic River). • Reserve Channel: blind corner caused by tall building (cargo warehousing and offices). Cannot see outbound cruise ships as you are moving down stream in the main harbor. • No ranges; CG just completed a WAMS for Boston Harbor. No need for ranges was identified. • Background lighting problems: 1. Sewer plant when entering harbor from North Channel. 2. North Jetty has bright lights which restrict ability to look beyond it up river. 3. Chelsea River; lower 2/3 is bad. • Red and green lights at waterside traffic lights can sometimes confuse operators.	**Existing mitigation:** • Existing bridge-to-bridge radio communications **New mitigation:** • Ranges may help with night navigation on the Fore River.
Passing Arrangements	• Narrow channels/restrictions: 1. Fore River 2. Chelsea River is one-way 3. Chelsea Bridge 4. Tobin Bridge channel width is 600 feet wide; the bridge pillars are farther apart than the channel. 5. Fore River bridge 6. Dorchester Bay; channel is 75 feet wide, narrow and shallow. Park service runs tours out the channel and some commuter boats also. No commercial tank vessel traffic. 7. Neville Channel (increase commuter traffic). • Harbor draft of 40-foot is limited by the constraints due to tunnels. Restricts size of tankers and will ultimately require off loading. • Chelsea River should also be 40 feet but cannot because of utilities. Cost-benefit ratio did not warrant relocating the under river lines (gas, power). • In several channels throughout the harbor and approaches there 35- and 40-foot sides. In this situation there are often times when there are two whistle passings so the loaded inbound ship can go to the deeper water to pass.	**Existing mitigations:** • One-way traffic for deep draft vessels in Chelsea River. • Channel is 1200 feet wide in main harbor. • Deep draft vessels now navigate Fore River in daylight. **New mitigation:** • No new mitigation factors were discussed.

Continued Next Page

RISK FACTORS	RISKS	MITIGATIONS
Waterway Configuration (Continued)		
Passing Arrangements (Continued)	• Call in mast head heights to the Logan Airport control tower because larger ships enter into the flight line. Mast height >120' is threshold. Airport reports that in thick weather, all targets are treated as 150 feet. • LNGs do not call tower to advise of ship transits. • Cruise ships also enter the landing air space. • Running 4R is used for ILS Category II approaches over the Reserve Channel.	
Channel and Bottom	• Hard ledges discovered during dredging in Chelsea River. • Hard ledges around Reserve Channel mouth. • Hard ledges in approaches to Boston and across the President Roads main ship channel to just east of the Reserve Channel. • Mystic Channel at the bend. • Buoys 13, 15, 17 in south channel is another ledge. • Accuracy of position of sunken barge on edge of President Roads is questionable.	**Existing mitigations:** • Tunnels limits harbor depth. • Channels are well marked. • Double hull requirements. • Army Corp of Engineers (ACOE) provides biennial reporting on charted depths for channels. **New mitigations:** • Update charting information.
Waterway Complexity	Boston has several bends and turns and intersecting waterways. • Sharp bends include the following: 1. Chelsea River entrance 2. Mystic River entrance 3. Hull Gut • Converging waterways: 1. Lights on buoys at Boston North and South channel entrances from seaward. South channel was not lit in the past. Can cause confusion. 2. Reserve Channel 3. Charles River locks should have passing arrangements. • Crossing traffic 1. Eastern end of President Roads 2. Narrows north of George's Island	**Existing mitigations:** • Channel 13 security broadcasts • Daylight transits • Good buoyage • Education; commercial operators know basic seamanship and navigation. • Pilotage requirements in place • CG has adjusted light patterns to help distinguish North and South entrance channels. **New mitigation:** • No new mitigation factors were discussed.

Continued Next Page

RISK FACTORS	RISKS	MITIGATIONS
Short-term Consequences		
Volume of Passengers	Highest risk factor for Port of Boston • Cruise ships: 1. Number of cruise ships increasing 2. Number of crew and passengers ~3000 • Ferry operations occur in the following areas: 1. Quincy (carries 200 passengers); 2. Salem (carries 200 passengers); 3. Cross channel airport ferry; 4. Back River; 5. Hingham Cove; 6. Island ferries: • Boston Light • George's Island • Lovell's Island • Peddocks Island 7. World Trade Center 8. North Station 9. Situate (long haul) 10. Long Wharf • Whale watch boats • Recreational traffic • Booze cruises **Trend:** • Ferry traffic increasing	**Existing mitigations:** • Presence of CG rescue forces • Existing regulations • Required safety equipment • Preparedness: training for crew and passengers **New mitigation:** • None needed; existing mitigators adequate. • Casualty history is zero.

Continued Next Page

RISK FACTORS	RISKS	MITIGATIONS
Short-term Consequences (Continued)		
Volume of Petroleum Cargoes	80% of cargo is petroleum but only 50% of the transits are petroleum ships. • Petroleum terminals: 1. Fore River; 2. Towne River; 3. Mystic River; and 4. Chelsea River-preponderance of petroleum terminals. • Tugs and barges: 1. Predominantly oil, bringing oil in from New York 2. Lightering from Anchorage #2, President Roads	**Existing mitigations:** • Preparedness through response organizations and equipment • Design requirements (double hulls) • Lessons learned: cause and effects of casualties • Under keel clearance – 2 feet underway, 1 foot at berth based on state of tide. • Spills rarely from tank vessels in transit-by facilities or during transfers. But, once in water, becomes a risk regardless of source. • Oily water separators **New mitigations:** • Enforce existing certification requirements for operators. • Change design of bridge scheme, Chelsea Street Bridge (pilots want bridge as is-have procedures in place. Bigger bridge will bring bigger ships). • Dredge Channel (pilots want left as is-will only bring in bigger ships). • Dockside inspection of pipes, valves, catchments at oil transfer facilities: 1. Stricter regulations 2. Stricter enforcement of regulations • Risk, though high, is at an acceptable level – half of group felt this way. • Oily water separators
Volume of Hazardous Chemical Cargoes	• LNG at Mystic River is most significant - 1 ship per week • Town River: Caustic Soda • Scrap dock in Mystic River; metal turnings	No mitigation factors were discussed.

Continued Next Page

RISK FACTORS	RISKS	MITIGATIONS
Long-term Consequences		
Economic Impacts	• If the waterway shuts down: 1. Chelsea River is all petroleum. No heating oil or gasoline; 5 to 6 day supply. 2. 8-day supply of jet fuel at Logan Airport • Impact on tourism 1. Dollars lost by booze boats 2. Dollars lost by tour boats 3. Cruise liners • Commuter boats cause automobile traffic problems. • Ferries may not be able to visit the outlying communities. • If Mystic lock shuts down, recreational boating and DUCKs are affected. • Lobster fisheries are impacted if an oil spill occurs.	**Existing mitigations:** • Preparedness and response: get port opened as quickly as possible. • Wreck removal equipment is in New York. Transit time plus removal time. • Alternative logistics for continuing import of fuels, natural gas. • Rail (tankcar) and road (tanker truck) capabilities are marginal in capability. **New mitigations:** • Identify critical parts of channels. • Identify and catalog equipment to remove wrecks of selected dimensions based on traffic type through each choke point. • Identify timetable to move salvage equipment from NYC. • Identify alternatives to enhance tank car and truck movement of oil.
Environmental Impacts	• All islands: 1. Historical significance 2. Spawning grounds and nurseries for crustations • Water fowl habitats: 1. Marsh areas in Winthrop. 2. Nepaunset River watershed 3. Marshes surrounding airport 4. Chelsea River and Mystic River for alewives 5. Lobsters throughout the harbor 6. Flounder at Deer Island 7. Deer Island sewage treatment	No mitigation factors were discussed.

Continued Next Page

RISK FACTORS	RISKS	MITIGATIONS
Long-term Consequences (Continued)		
Health and Safety Impacts	• Drinking water not an issue; piped from elsewhere. • Large resident port population • LNG: Hazardous chemical activity • Closure of Chelsea River denies heating oil (price and availability) to poor. • Water intakes for power plants 1. Reserve Channel near cruise liners 2. Mystic River near LNG facility	No mitigation factors were discussed.